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ABSTRACT

The cognitive styles of Education majors at a southern university were examined over a 5-year period. The Group Embedded Figures Test (GEFT) was administered to 537 students in an introductory education course. This test identifies field-dependent (FD) and field-independent (FI) learning styles. One hundred ninety-six students were retested at the conclusion of their internships. In the interim, course grades across six required undergraduate courses were compared with cognitive style. Findings indicated that students became more field-independent with time. Males tended to be more field independent than females, but females performed better academically across the six courses. Students with higher course grades generally had higher embedded figures scores in all six courses. (Contains 23 references.) (Author/PB)

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ED 382 612



# Changing the Cognitive Style of Preprofessional Students

F. Morgan Simpson, Sarah C. Portis, and Robert A. Wieseman

Auburn University at Montgomery
Montgomery, Alabama 36117-3596

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Nashville, Tennessee
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Running Head: CHANGING THE COGNITIVE STYLE

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Abstract

The cognitive styles of Education majors at a southern university were examined over a five-year period. The Group Embedded Figures Test (GEFT) was administered to 537 students in an introductory education course. This test identifies field-dependent (FD) and field-independent (FI) learning styles. One hundred ninety-six students were retested at the conclusion of their internships. In the interim, course grades across six required undergraduate courses were compared with cognitive style. Findings indicated that the students became more field-independent. Males tended to be more FI than females, but females performed better academically across the six courses. Further significant correlations exist between the students' grades in the six courses, and the students with the higher course grades had higher embedded figures scores (indicating they were more field-independent). Significant F values were found in four courses. A similar pattern, though not significant, was found in the other two courses. Students with higher course grades generally had higher mean embedded figures scores in six selected courses.

# Changing the Cognitive Style of Preprofessional Students

An understanding of how people learn is an essential component of a teacher-preparation program. Learning styles research indicates that how teachers teach and interact with their students and how students learn and interact with others are affected by learning styles (Reiff, 1992). Learning styles are defined as patterns that direct the teaching, learning process. Individuals have a predisposition to certain cognitive, affective and physiological styles of learning; however, personal development and maturation, culture and experience influence style (Cornett, 1983). Even as maturational changes occur, most people remain somewhat fixed in cognitive style. Males tend to be more field independent than females, but it is unknown if cultural influences are involved (Sigel & Brodzinsky, 1977). Cognitive style addresses how individuals learn, perceive, think, and problem solve. Affective dimensions of learning style include individual personality and emotional traits, while physiological dimensions of learning style relate to individual reactions to environmental and sociological conditions (Reiff, 1992).

Cognitive style influences academic major (Highhouse & Doverspike, 1987; Witkin, 1976). Individuals who are field-dependent (FD) tend to select fields like teaching, counseling, sales, humanities, and social sciences, while individuals who are field-independent (FI) tend to select scientific, mathematics, engineering and related fields.

Cognitive style influences approaches to learning. Field-dependent learners are attuned to learning and retaining social information and they enjoy group interaction. These students will benefit from working in groups and receiving feedback from peers and the teacher. They favor structure and seek teacher direction and feedback. They are affected by criticism and they

benefit from instruction in problem solving. Field-independent learners, on the other hand, are task-oriented and they set self-regulated goals. They tend to be more skilled at learning and using rules. They can organize and analyze a plan and they seek less guidance than do FD learners. They are less affected by criticism and they like to work individually (Piotrowski, 1984; Witkin, Moore, Goodenough, & Cox, 1977). Field-independent learners prefer relatively impersonal situations and they maintain greater psychological and personal space from others than do FD persons (Greene, 1976).

Cognitive style affects teaching methods and curricula. Field-dependent teachers tend to use discussion more and FI teachers tend to use lecture more in their classes. Field-dependent teachers tend to use more democratic classroom procedures, while FI teachers lean toward more direct methods of influencing students (Witkin, 1976). Neill (1990) and Reiff (1992) suggest that knowledge about learning styles can aid the teacher in broadening teaching methods and curricula to accommodate more students' preferred styles. Classroom management and lesson planning based on learning styles knowledge facilitates greater learning on the part of all students. As accommodations for students' learning styles are made by instructors, students are exposed to a variety of ways to learn and their repertoire of styles is expanded. This procedure strengthens their school performance (Matthews, 1991a). Matching instructional style with student learning style may not increase student learning (Macneil 1980); however, teachers and students tend to rate one another more positively when their cognitive styles are matched (Witkin, 1976). Teacher versatility in structuring curricula and instructional strategies seems to be essential for effective teaching to occur (Goodlad, 1984).

Cognitive styles of Education majors appear to have an impact on performance in pre-service education coursework (Wieseman, Portis, & Simpson,

1992b). A two-year study of 537 students enrolled in an introductory education course revealed that students with higher means on the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971) tended to perform academically better than those with lower means. Matthews (1991b) found in a study of upperclassmen across majors that Education majors tended to select "conceptual over applied learning styles and social over independent learning styles" (p.19). She found some students in this group preferred a neutral style which she and Canfield (1988) report is associated with students whose performance is less successful than students who have a preferred style. She further points out that Education majors generally do less well on standardized tests that require application. She, along with Claxton & Murrell (1987), advocate that Education faculty use a variety of instructional strategies that address match/mismatch of styles between instructor and student to facilitate expansion of student styles. This practice may assist students in developing skills needed to improve performance on standardized tests.

Purposes

The present study examines cognitive styles of preprofessional Education majors. The purposes of this descriptive study were:

1. To determine if student scores on the Group Embedded Figures Test (GEFT) remained static over the period of baccalaureate teacher preparation.
2. To compare students' academic performance across curricula.
3. To investigate the relationship between GEFT scores and course grades in selected required courses.

## Method

Materials

The Group Embedded Figures Test (GEFT) was designed by Witkin, Oltman,

Raskin, and Karp (1971) to determine field-dependent and field-independent cognitive styles. The GEFT is a timed test designed for group administration. The test requires subjects to locate and mark embedded figures in eighteen complex designs. The range of scores is 0 (field-dependent) to 18 (field-independent). Scores indicate the degree of cognitive style.

The GEFT has been used in over 2,800 studies to screen large numbers of subjects and to conduct correlational studies. Such usage is in line with the stated purposes of the instrument (Cantwell, 1986). Although Cantwell states that more data are needed in the manual regarding different group norms, reliability, and validity, he regards it as appropriate for use by researchers studying cognitive styles.

Procedures

The researchers administered the Group Embedded Figures Test during part of one class session in every section of a freshman level introduction to education course for two academic years (1989-90 and 1990-91). The test was repeated as the same students completed their internship during the senior year. This research reports the retesting of the students who completed their internship in spring and fall of 1992; winter, spring, and fall of 1993; and winter and spring of 1994. Course grades were also collected of the students in six courses required of all undergraduate education majors at a southern university.

Subjects

The subjects were students enrolled in a freshman level introductory education course at a southern university. Data from 537 students enrolled in the course were collected, and results from that study are reported in Wieseman, Portis, and Simpson (1992a). The same students are being retested at the completion of the internship. Data were collected from 196 students. One hundred seventy-four students were female and twenty-two students were

male. Additional data on the other students will be collected at the conclusion of their internships. The researchers did not collect data on race or teaching field.

## Results

Initial and intern field-dependent/independent scores, course grades from six courses, and gender were collected for all subjects in the study. The mean and standard deviations for the field-dependent/independent scores are reported by gender in Table 1.

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Insert Table 1 about here

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The mean field-dependent/independent scores for all students, both females and males, were higher during the internship. Higher mean scores during the internship suggest that the Education students became more field-independent learners as they progressed through the teacher-preparation program. There were significant differences between the female and male students on both the initial and intern testings (initial $t = -3.75$, $p = 0.0007$ and intern $t = -3.34$, $p = 0.002$). The graphic representation of the field-dependent/independent scores by gender for the initial and intern testing are reported in Figure 1.

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Insert Figure 1 about here

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The box plot represents the range and central tendencies of the data. The graphic representation of the middle 50% of the students is shown in the box. The box plot further illustrates the tendency for the students to have higher scores at the completion of the internship, thus indicating the

students became more field-independent.

The comparisons between the initial and intern field-dependent/independent scores for all students and gender groups are reported in Table 2.

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Insert Table 2 about here

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Significant t-test results were found for all students and the females ($t = 6.49$, $p = 0.0001$), females ( $t = 6.18$, $p = 0.0001$). The results for the males ($t = 1.96$, $p = 0.06$) were not significant. Students' field-dependent/independent scores changed and became more field-independent between their initial testing in the introduction to education course and their testing at the completion of the internship. Student scores on the Group Embedded Figures Test did not remain static over the period of baccalaureate teacher preparation.

Course grades were collected for the 196 students in six courses required of all undergraduate education majors. The courses selected were introduction to education (FED 104, Introduction to Professional Education); history (HY 102, World History Since 1648); English (EH 102, English Composition II); biology (BI 101, Principles of Biology); speech (COM 101, Introduction to Human Communication); and fine arts (one of the appreciation or history courses in either art, music or theater). Students were not enrolled in a single fine arts course; rather, students selected one of nine possible courses. Students enrolled in the internship are awarded S (satisfactory) or U (unsatisfactory) grades rather than traditional letter grades. For this reason, intern grades are not included in this report. The means and standard deviations for the course grades, along with t-test results, are reported by gender in Table 3.

Insert Table 3 about here

Female students had higher course grade means then males for all six courses. Comparisons between the grades of male and female students in each course produced significant t-test results in only one course, fine arts. Results in the comparisons for the other courses were not significant. Students in FED 104 had the highest mean score (3.40) and students in HY 102 had the lowest mean score (2.75). One student did not have a fine arts grade and another did not have a communication grade on their transcripts, so the total number and the number of female subjects are different for the other courses.

The course grades were compared using the Pearson Correlation Coefficient. The correlations of the grades in the six courses are reported in Table 4.

Insert Table 4 about here

Significance correlations were calculated between the grades in all of the courses. For example, the grades in FED 104 were significantly correlated to the grades received in each of the other five courses. This finding suggests that the grades received by students in the six courses followed similar patterns. Difference scores were calculated by subtracting the grades in the six courses two at a time for each student. The difference scores and the t-test results are reported in Table 5.

Insert Table 5 about here

Significant mean difference scores were found between FED 104 and each of the other courses. The positive mean difference scores indicate the FED 104 course grades were generally higher than the course grades in the other five courses. Significant mean difference scores were also found between each of HY 102, EH 102, and BI 101 and COM 101 as well as between these courses and Fine Arts. Therefore, students' academic performance was not similar across the curricula.

The course grades, initial and intern field-dependent/independent scores were further analyzed by calculating the Pearson Correlation Coefficients and an Analysis of Variance (ANOVA). The relationships between student scores and grades in the six courses are reported in Table 4. The initial embedded figures scores were found to be significantly correlated to the grades received in FED 104, EH 102, and fine arts. The intern field-dependent/independent scores were also found to be significantly correlated to grades in FED 104, Hy 102, EH 102 and Fine Arts. There were also several courses where significant correlations were found between students' course grades. The significant score/grade correlations suggest that students' scores and grades followed similar patterns.

The course grades and embedded figures scores for the interns were further analyzed by ANOVA. A factorial ANOVA was calculated by partitioning the course grades and intern scores for each of the six courses. ANOVA results, plus group means and standard deviations, are reported in Table 6.

Insert Table 6 about here

Significant F values were found in FED 104, HY 102, EH 102, and Fine Arts. In these courses (FED 104, EH 102, HY 102, and Fine Arts), as well as the other courses, students with higher course grades generally had higher mean embedded figures scores. These differences were significant for four of the courses, but the same basic pattern, though not significant, occurred in the other two courses (BI 101, and COM 101). There is a relationship between GEFT scores and course grades.

## Discussion

The results of this investigation indicate that Education majors who were identified as having a field-dependent cognitive style when tested in their first education course, tended to become more field-independent by the end of their internship. This finding suggest that while style may not change there is movement toward field-independence. Males tended to be more field-independent than females, although females performed better academically across curricula.

The students involved in this study were screened twice between the two administrations of the Group Embedded Figures Test by the School of Education. Students were screened for Admission to Professional Education and for admission to the Internship. Students not maintaining a 2.50 GPA are screened out of the School of Education. The researchers did not identify students who disenrolled. The researchers do not know how many students will not be admitted to both professional education and the internship. This study describes only the students from the initial pool of 537 students who have completed the internship. No control group was used.

Studies of retention of college students have focused primarily on remedial study skills and support services; however, they indicate that these traditional approaches are inappropriate for a large number of students (Ford, 1981; Robyak & Downey, 1979). Recent research (Nelson, Dunn, Griggs,

Pimavera, Fitzpatick, Bacillious, & Miller, 1993) found that students who were taught to use their learning style preferences had greater achievement than students who have little or no exposure to instruction in using learning style preferences in developing study skills. Students with this instruction were found to be more apt to remain in college.

Research (Thompson & Crutchlow, 1993) seems to indicate there is little evidence that learning style has a significant impact on learning. It does impact student performance (Mathews, 1991a; Wieseman et al., 1992b).

This study documents the changes in field-dependent/independent scores over time for preprofessional baccalaureate-level students. Students in this study tended to become more field independent. This trend appears to be desirable since teacher versatility in structuring curricula and instructional strategies seems to be essential for effective teaching to occur (Goodlad, 1984)

Student grades in the six selected courses seem to follow similar patterns. The significant correlations between the course grades indicate that students performed in similar fashion in the selected courses.

The embedded figures score/course grade analyses suggest that there is a relationship between the two. Students with higher course grades had higher embedded figures scores in all six courses. The differences in four of the six courses were found to be significant.

Continuing research that employs the same design and instrument will increase the number of subjects and enhance the power of the results. Additional research comparing cognitive style and academic major (though not a part of this research design) would add a further dimension to current findings; for example, research indicates that cognitive style influences vocational choice and academic performance (Highhouse & Doverspike, 1987; Witkin, 1976). Further study might focus on the match-mismatch of student and

instructor cognitive styles since research implies that the match-mismatch of cognitive styles may be a factor in student academic performance (Macneil, 1980; Witkin, 1976).

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Table 1

Mean and Standard Deviation Field Dependent/Independent Scores by Gender and t-test

| Group | N | % | Mean | SD | T | P |
|---|---|---|---|---|---|---|
| Initial Scores | | | | | | |
| All Students | 196 | 100 | 9.79 | 5.04 | -3.75* | 0.0007 |
| Female | 174 | 89 | 9.44 | 5.09 | | |
| Male | 22 | 11 | 12.64 | 3.57 | | |
| Intern Scores | | | | | | |
| All Students | 196 | 100 | 11.34 | 4.67 | -3.34* | 0.002 |
| Female | 174 | 89 | 11.03 | 4.71 | | |
| Male | 22 | 11 | 13.82 | 3.53 | | |

Table 2

Mean Initial and Intern Field Dependent/Independent Scores and t-test

| Group | N | Initial | Intern | T | P |
|---|---|---|---|---|---|
| All Students | 196 | 9.79 | 11.34 | 6.49* | 0.0001 |
| Female | 174 | 9.44 | 11.03 | 6.18* | 0.0001 |
| Male | 22 | 12.64 | 13.82 | 1.96 | 0.06 |

Table 3

Mean and StandardDeviation of Course Grades by Gender and t-test

| COURSE | N | Mean | SD | T | p |
|---|---|---|---|---|---|
| FED 104 | 196 | 3.40 | 0.75 | 1.13 | 0.27 |
| Female | 174 | 3.42 | 0.75 | | |
| Male | 22 | 3.23 | 0.75 | | |
| HY 102 | 196 | 2.75 | 0.97 | 1.17 | 0.25 |
| Female | 174 | 2.77 | 0.99 | | |
| Male | 22 | 2.55 | 0.86 | | |
| EH 102 | 196 | 2.95 | 0.83 | 1.72 | 0.10 |
| Female | 174 | 2.99 | 0.83 | | |
| Male | 22 | 2.68 | 0.78 | | |
| BI 101 | 196 | 2.83 | 0.94 | 1.42 | 0.17 |
| Female | 174 | 2.87 | 0.94 | | |
| Male | 22 | 2.59 | 0.85 | | |
| COM 101 | 195 | 3.22 | 0.74 | 1.62 | 0.12 |
| Female | 173 | 3.26 | 0.72 | | |
| Male | 22 | 2.95 | 0.84 | | |
| Fine Arts | 195 | 3.27 | 0.82 | 2.20* | 0.04 |
| Female | 173 | 3.31 | 0.81 | | |
| Male | 22 | 2.91 | 0.81 | | |

Table 4
Correlation of Course Grades and Group Embedded Figures Scores

| Courses | Initial | Intern | FED 104 | HY 102 | EH 102 | BI 101 | COM 101 | Fine Arts |
|---|---|---|---|---|---|---|---|---|
| Initial | | 0.77*<br>0.0001 | 0.22*<br>0.002 | 0.11 | 0.21*<br>0.003 | 0.14 | 0.10 | 0.20*<br>0.005 |
| Intern | | | 0.23*<br>0.001 | 0.18*<br>0.01 | 0.22*<br>0.002 | 0.17*<br>0.02 | 0.11 | 0.23*<br>0.001 |
| FED 104 | | | | 0.33*<br>0.0001 | 0.31*<br>0.0001 | 0.29*<br>0.0001 | 0.28*<br>0.001 | 0.23*<br>0.001 |
| HY 102 | | | | | 0.35*<br>0.0001 | 0.36*<br>0.0001 | 0.39*<br>0.0001 | 0.23*<br>0.001 |
| EH 102 | | | | | | 0.43*<br>0.0001 | 0.36*<br>0.0001 | 0.34*<br>0.0001 |
| BI 101 | | | | | | | 0.40*<br>0.0001 | 0.30*<br>0.0001 |
| COM 101 | | | | | | | | 0.37*<br>0.0001 |
| Fine Arts | | | | | | | | |

* indicates significance and p is provided below on the next line.

Table 5

Mean Difference Scores for Course Grades and t-test

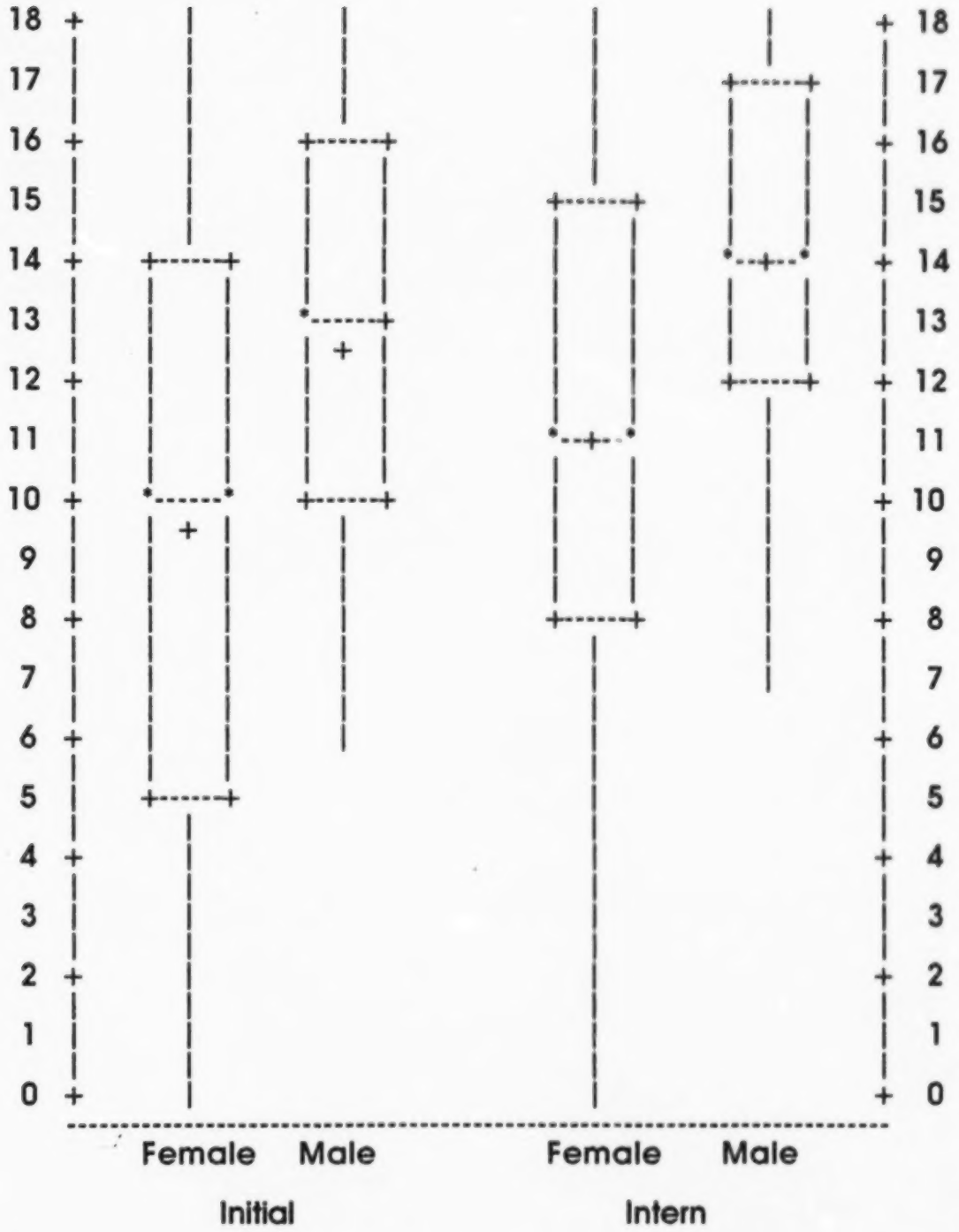
| COURSE | Mean | Differences | Mean | SD | T | p |
|---|---|---|---|---|---|---|
| FED 104 | 3.40 | | | | | |
| | | - HY 102 | 0.65 | 1.01 | 8.99* | 0.0001 |
| | | - EH 102 | 0.44 | 0.93 | 6.69* | 0.0001 |
| | | - BI 101 | 0.56 | 1.01 | 7.75* | 0.0001 |
| | | - COM 101 | 0.17 | 0.89 | 2.76* | 0.007 |
| | | - Fine Arts | 0.14 | 0.97 | 1.99* | 0.05 |
| HY 102 | 2.75 | | | | | |
| | | - EH 102 | -0.20 | 1.04 | -2.75* | 0.006 |
| | | - BI 101 | -0.09 | 1.08 | -1.13 | 0.26 |
| | | - COM 101 | -0.47 | 0.97 | -6.79* | 0.0001 |
| | | - Fine Arts | -0.52 | 1.12 | -6.47* | 0.0001 |
| EH 102 | 2.95 | | | | | |
| | | - BI 101 | 0.12 | 0.94 | 1.75 | 0.08 |
| | | - COM 101 | -0.27 | 0.89 | -4.25* | 0.0001 |
| | | - Fine Arts | -0.31 | 0.95 | -4.61* | 0.0001 |
| BI 101 | 2.84 | | | | | |
| | | - COM 101 | -0.38 | 0.93 | -5.80* | 0.0001 |
| | | - Fine Arts | -0.43 | 1.04 | -5.72* | 0.0001 |
| COM 101 | 3.23 | | | | | |
| | | - Fine Arts | -0.04 | 0.88 | -0.57 | 0.57 |
| Fine Arts | 3.27 | | | | | |

Table 6
Comparison of Course Grades by Intern Embedded Figures Scores

| Course | Grade | N | Mean | SD | DF | F Value | P |
|---|---|---|---|---|---|---|---|
| FED 104 | | | | | 4, 191 | 2.90* | 0.02 |
| | A | 104 | 12.11 | 4.56 | | | |
| | B | 70 | 11.00 | 4.47 | | | |
| | C | 19 | 9.37 | 4.89 | | | |
| | D | 2 | 6.50 | 7.78 | | | |
| | F | 1 | 4 | | | | |
| HY 102 | | | | | 4, 191 | 3.08* | 0.02 |
| | A | 50 | 11.98 | 4.74 | | | |
| | B | 68 | 11.69 | 4.69 | | | |
| | C | 60 | 11.55 | 4.39 | | | |
| | D | 15 | 7.73 | 4.20 | | | |
| | F | 3 | 8.00 | 4.58 | | | |
| EH 102 | | | | | 4, 191 | 4.26* | 0.003 |
| | A | 57 | 12.63 | 4.07 | | | |
| | B | 78 | 11.58 | 4.75 | | | |
| | C | 57 | 9.89 | 4.68 | | | |
| | D | 3 | 6.00 | 3.00 | | | |
| | F | 1 | 18 | | | | |
| BI 101 | | | | | 3, 192 | 2.46 | 0.06 |
| | A | 57 | 12.33 | 4.14 | | | |
| | B | 64 | 11.31 | 4.85 | | | |
| | C | 61 | 11.07 | 4.94 | | | |
| | D | 14 | 8.71 | 3.87 | | | |
| COM 101 | | | | | 2, 192 | 1.29 | 0.28 |
| | A | 80 | 12.01 | 4.65 | | | |
| | B | 79 | 11.04 | 4.63 | | | |
| | C | 36 | 10.57 | 4.66 | | | |
| Fine Arts | | | | | 3, 191 | 3.52* | 0.02 |
| | A | 92 | 12.40 | 4.21 | | | |
| | B | 69 | 10.93 | 4.98 | | | |
| | C | 28 | 9.89 | 3.96 | | | |
| | D | 6 | 8.67 | 6.19 | | | |

## Figure Caption

Figure 1. Box plot by gender of group embedded figures scores for both initial and intern testing.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